Improved quantification of far-infrared water vapor absorption by long-term radiative closure measurements at the Zugspitze

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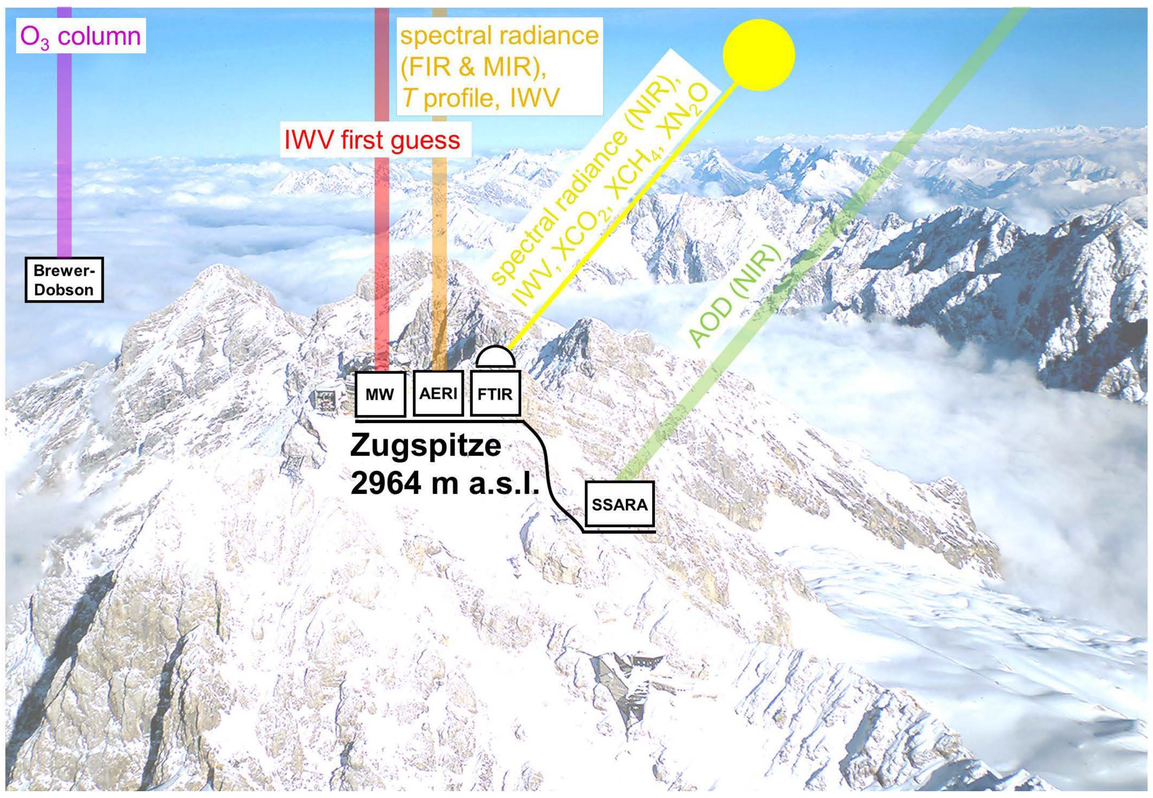
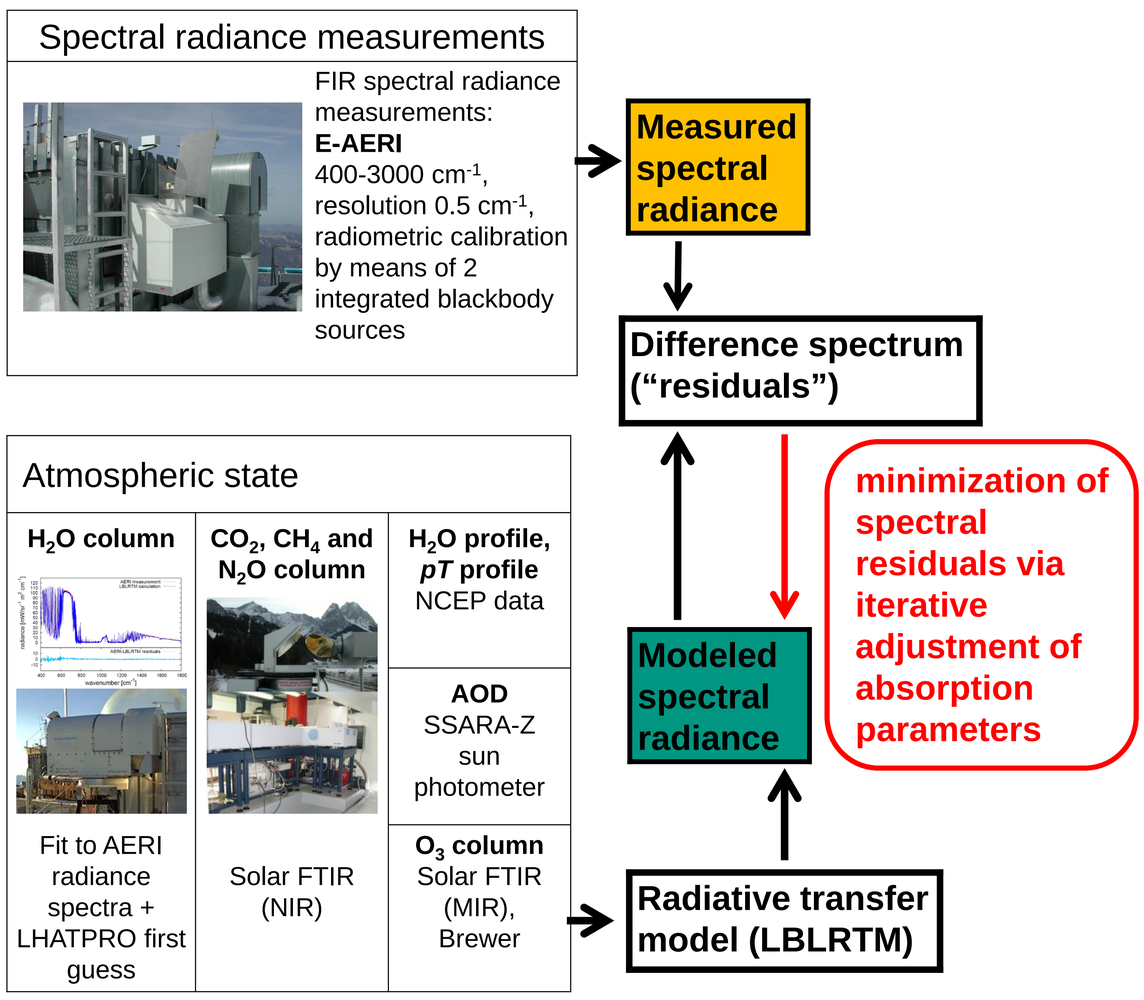
Abstract

- Missing quantitative knowledge of water vapor absorption is a key problem that limits accuracy of atmospheric radiative transfer calculations, e.g. in climate models
- Zugspitze site offers ideal conditions for high-precision closure study: extensive instrumentation, long-term measurements, very low IWV
- First results include validation of water vapor line parameters and continuum coefficients

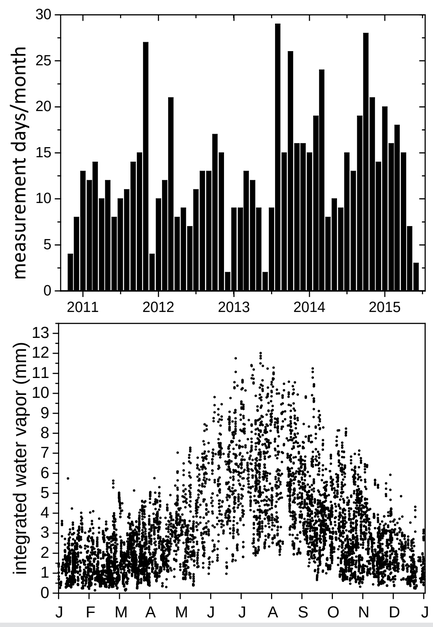
Instrumental setup



Principle of radiative closure



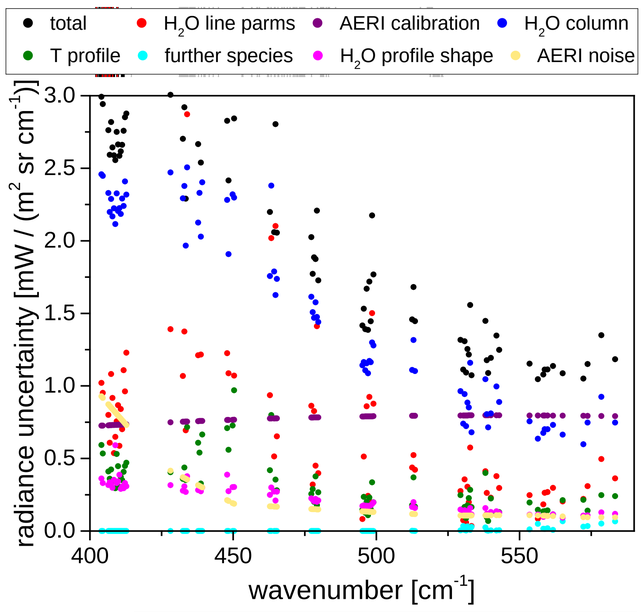
Long-term closure measurements



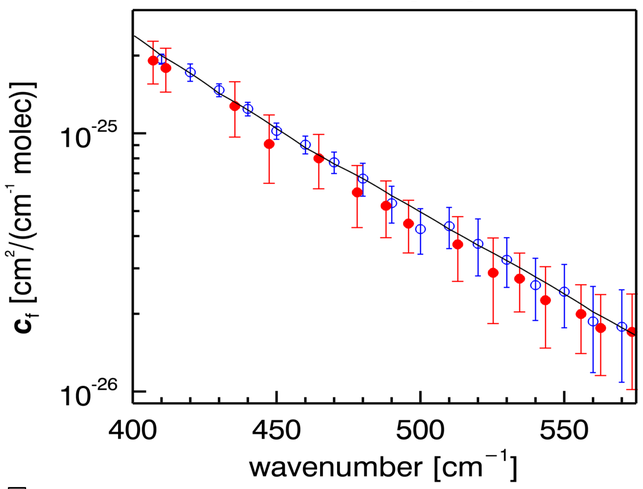
← Measurement statistics of the long-term closure measurements with the Zugspitze E-AERI

← IWV climatology of the Zugspitze site derived from multi-annual solar FTIR measurements. Very dry scenes (IWV < 1mm) frequently occur during winter

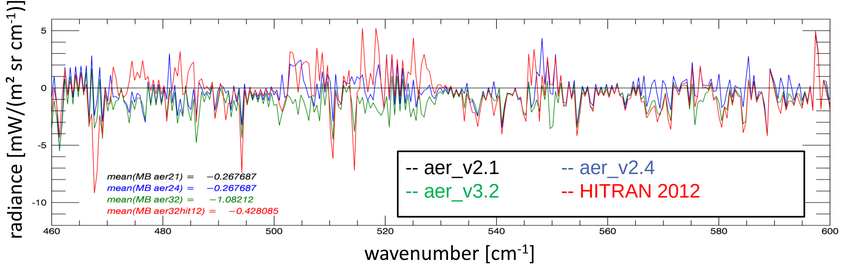
Results



← Contributions to residual uncertainty budget and overall uncertainty (2 σ) of the FIR closure experiment



← Mean FIR water vapor foreign continuum coefficients derived from the Dec 2013 - Feb 2014 Zugspitze measurements (red), MT_CKD 2.5.2 model (Mlawer et al., 2012) (black), Liuzzi et al. (2014) (blue)



↑ Validation of line parameter databases via mean AERI-LBLRTM radiance residuals

References

Liuzzi, G. et al.: Validation of H_2O continuum absorption models in the wave number range 180-600 cm^{-1} with atmospheric emitted spectral radiance measured at the Antarctica Dome-C site, Opt. Express, 22, 16784-16801, 2014.

Mlawer, E. J. et al.: Development and recent evaluation of the MT_CKD model of continuum absorption, Phil. Trans. R. Soc. A, 370, 2520–2556, 2012

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